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A<sup>2</sup>

In one embodiment, the method includes cleaning the non-conductive substrate. In a typical cleaning, the surface of a non-conductive substrate to be treated is cleaned to remove deposits such as fingerprints, fats and oils and like organic substances, and/or dust deposited due to electrostatic action. Conventional degreasing agents can be used as a treating solution. For example, an alkaline degreasing agent or the like may be used.

Please delete in its entirety the paragraph beginning on page 5, line 20 and ending on page 6, line 2 and replace it with the following paragraph.

A<sup>3</sup>

In one embodiment, a physical/chemical pretreatment for surface modification of the non-conductive substrate is applied prior to application of the method of the present invention. The surface modification results in a roughened surface having an increased surface area and having an increased susceptibility to attachment of metal ions in subsequent treatment steps. The surface modification pretreatment is intended to enhance attachment of metals in the subsequent steps. The surface modification treatment may include, for example, a solvent swell, a chromic acid etch, a non-chromic acid etch, a plasma treatment, or other known processes for surface preparation, such as lamination and removal of a roughened metal layer from the non-conductive substrate.

Please delete in its entirety the paragraph on page 7, lines 1 - 6 and replace it with the following paragraph.

A<sup>4</sup>

In one embodiment, the surface modification includes treatment with a solvent which causes the surface of a polymeric non-conductive material to swell and become easier to etch. This may be especially desirable when employing those polymeric materials that are inherently hydrophobic and/or have a very low surface porosity such as various polyimides, including the polyetherimides.

Please delete in its entirety the paragraph on page 7, lines 13 - 21 and replace it with the following paragraph.

A<sup>5</sup>

The choice of solvent depends to some degree on the specific polymeric non-conductive material which is to be metallized. Suitable solvents are known in the art, and may be appropriately selected. Suitable

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END A<sub>5</sub>  
solvents include, for example, glycol ether esters such as acetates, N-alkyl pyrrolidones, aliphatic alcohols, aliphatic amines, alkali metal hydroxides, butyl and ethyl Cellosolve® (butyl is 2-butoxy ethanol), butyl Carbitol® (2-(2-butoxyethoxy)ethanol), and ethylene glycol. Other useful solvents include 2-butoxy ethyl acetate (EBA), propylene glycol monomethyl ether (Dowanol PM), and propylene glycol monomethyl ether acetate (Dowanol PMA).

Please delete in its entirety the paragraph beginning on page 9, line 26 and ending on page 10, line 8 and replace it with the following paragraph.

A<sub>6</sub>  
In one embodiment, in the conditioning step, a neutralizer comprising an acid salt of a reducing agent is applied to the non-conductive substrate. The reducing agent may be one or more of hydrazine, which may be present as a derivative such as hydrazine hydrate, hydrazine sulfate, neutral hydrazine sulfate or hydrazine maleate, hydroxylamine, mono-, di- or tri-ethanolamine, glyoxylic acid, aldehydes such as formaldehyde, benzaldehyde, glyoxal, vanillin or acetaldehyde, hypophosphite, hydrogen borate such as NaBH<sub>4</sub> or KBH<sub>4</sub>, N-dimethylamine borane (DMAB), N-diethylamine borane (DEAB), sodium thiosulfate, sodium ascorbate, monosaccharide, disaccharide or polysaccharide, for example, sucrose. The acid of the acid salt of a reducing agent may be a mineral acid such as hydrochloric, sulfuric or phosphoric, or it may be a sulfonic acid, or it may be a carboxylic acid.

Please delete in its entirety the paragraph on page 10, lines 18 - 21 and replace it with the following paragraph.

A<sub>7</sub>  
In one embodiment, in the conditioning step, a conditioner comprising at least one surfactant and at least one aliphatic amine is applied to the non-conductive substrate. In one embodiment, the at least one surfactant is one or more of nonionic, anionic, cationic or amphoteric surfactants.

Please delete in its entirety the paragraph beginning on page 10, line 27 and ending on page 11, line 2 and replace it with the following paragraph.

A<sub>8</sub>  
In one embodiment, a combination or mixture of a neutralizer and a

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conditioner, each as described above, is applied to the non-conductive surface. In one such embodiment, a combination of Futuron® Neutralizer and Conditioner CC-301 are employed. In another such embodiment, a combination of Futuron® Neutralizer and Futuron®-C Conditioner is employed.

Please delete in its entirety the paragraph beginning on page 12, line 23 and ending on page 13, line 6 and replace it with the following paragraph.

A<sup>9</sup>

The present inventor has discovered that, contrary to prior art teachings in which silver ion had been found to be generally unsatisfactory as a catalyst for electroless plating of a non-conductive substrate, under proper conditions silver provides excellent results in such an application. In the prior art, when silver was used in such catalyzing applications, the silver ion was present in an acidic medium. The present inventor has discovered that when silver ion is present in a solution having a pH in the range from about 5 to about 10, excellent catalysis for electroless plating is obtained. In one embodiment, the solution has a pH in the range from about 6 to about 9. The present inventor has discovered that the pH should not be acidic, e.g., below about pH 5, and the pH should not be increased to such a level that the silver becomes photosensitive, e.g., above about pH 10. Thus, an alkaline silver solution at a pH above about pH 10 would be unsatisfactory.

Please delete in its entirety the paragraph beginning on page 18, line 8 and ending on page 19, line 5 and replace it with the following paragraph.

A<sup>10</sup>

In one embodiment, an electroless silver layer is applied in the electroless plating step. In one embodiment, the electroless silver layer is applied by a method described in U.S. Patent No. 5,645,628 ('628 patent). The method of the '628 patent employs an electroless plating bath, comprising a silver material containing silver ions; a reducing agent for the silver ions which contains no metal in the chemical formula thereof; a complexing agent for the silver ions which contains no metal in the chemical formula thereof; and a pH control agent which contains no metal in the chemical formula thereof. The '628 patent discloses that the method is also useful for the electroless application of copper, nickel, cobalt, palladium and gold. The '628 patent discloses that the reducing agent comprises at least one substance selected from the group consisting of tartaric acid, tartrate containing no metal in the chemical formula thereof, monosaccharide, disaccharide, polysaccharide, hydrazine, a hydrazine derivative, aldehyde and polyol. The '628 patent discloses that the complexing agent for silver

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and copper comprises at least one substance selected from the group consisting of ethylenediamine, an ethylenediamine derivative, ammonia and triethanolamine. The '628 patent discloses that the ammonium salt and ammonia pH control agents are useful for adjusting the pH of silver and copper electroless plating solutions, with tetramethylammonium hydroxide (TMAH) preferred for use with silver. For silver plating, the '628 patent discloses that the reducing agent is preferably tartaric acid, the complexing agent is preferably ethylenediamine, and the pH control agent is preferably TMAH. The '628 patent discloses that the silver may be deposited by electroless plating at a pH of about 10. The entire disclosure of the '628 patent relating to electroless plating solutions is incorporated herein by reference. Other known electroless silver deposition methods compatible with the present invention may be used within the scope of the present invention.

END A<sub>10</sub>

Please delete in its entirety the table on page 23, lines 18 - 23 and replace it with the following table.

Material	
Silver Nitrate	500 mg/liter
Methane sulfonic acid (70%)	none
Triethanolamine	2 ml/liter
D. I. water	Balance
pH	~8.0

A<sup>11</sup>  
T.0240

Please delete in its entirety the paragraph on page 24, lines 29 - 30 and replace it with the following paragraph.

Good uniform metal coverage is observed in all four cases. No copper plating is observed on the plastisol rack coating.

A<sup>12</sup>

Please delete in its entirety the paragraph on page 25, lines 24 - 30 and replace it with the following paragraph.

Good electroless copper deposition is observed in all the cases. In the case of ABS/PC blend, polypropylene, polyphenyleneoxide and epoxy-glass, the test plaques processed through conditioner CC-301 show more rapid initiation of copper plating and somewhat better plating coverage

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than those processed without the conditioner CC-301. Plating initiation and coverage on ABS plastic is almost the same in both conditions. No plating is observed on the plastic rack coating in either case.

Please delete in its entirety the paragraph on page 27, lines 2 - 13 and replace it with the following paragraph.

A<sup>14</sup>

After appropriate pre-treatment (see note below), test plaques of engineering plastics NORYL® MX5553 (modified polyphenylene ether), ULTEM® 1010-1000 (polyether imide), carbon filled PEEK (polyether ether ketone), SUPEC® G301RA (polyphenylene sulfide), SEQUEL® 1440 (TPO from Solvay) and AMODEL® ET-1002L (modified polyphthalamide) are processed through etching and reducing steps. Such etched parts are then processed through conditioner CC-301/HC F45, a mixture of two Atotech conditioner products (a blend of cationic, non-ionic and amphoteric surfactants) followed by sensitizing, catalyzing and electroless copper plating steps as described in Example 4. Good electroless plating coverage is obtained within 3 minutes of plating in all cases except NORYL® MX 5553, for which about 10 minutes is taken to obtain complete coverage due to slow initiation.

Please delete in its entirety the paragraph on page 29, lines 9 - 22 and replace it with the following paragraph.

A<sup>15</sup>

ABS, ABS/PC and polypropylene test plaques are first etched in the chromic acid etch, rinsed and treated in the chrome reducer step with Futuron Neutralizer and rinsed. Such treated samples are then processed through Futuron C conditioner (0.5% in 2 % hydrochloric acid) and then further treated in the following sensitizer and catalyst steps:

Sensitizer: SnCl<sub>2</sub> 200 g/l and HCl (concentrated) 100 ml/l

Rinse (deionized water)

Catalyst: Aqueous AgNO<sub>3</sub> solution: Ag ions 150 mg/l; pH ~6.5

Rinse (tap water)

Such catalyzed samples are plated in COPPERSHIELD® LT (Atotech USA) electroless copper plating bath for 10 minutes at 35°C. Good copper plating is observed in all cases.

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